PA-19 December, 2002
Translated by: Ana Grigorian

Appendix 2
Approved by:
ERC Resolution No. 92, dated 24 December, 2002

ELECTRIC ENERGY (CAPACITY) METERING PROCEDURES

These Procedures shall regulate and organize of the functions of electric energy (capacity) metering and computation of unavoidable technological losses at the Wholesale Electric Energy (Capacity) Market of the Republic of Armenia (RoA).

1. Primary Concepts Used in These Procedures

The primary concepts used in this License are as follows:

Commission - the Energy Regulatory Commission of the Republic of Armenia, which is a regulatory body in the power sector;

License - a document issued to a legal entity by the Energy Regulatory Commission, certifying to the Company's right and obligation to carry out activities and to render services in the energy sector;

Licensee – a legal entity that has been issued a License, in conformance with the Energy Law of the Republic of Armenia;

Settlements Center Service Licensee (Settlements Center) – a legal entity that has been issued a License authorizing the provision of Settlements Center services in the energy sector, and which renders Settlements Center services to the licensed entities operating at the wholesale power market (WPM), on the basis of signed contracts and in established procedures;

Wholesale Buyer/Vendor – a legal entity carrying out a licensed operation in the power sector with a License giving an exclusive right for the implementation of functions of wholesale purchase of electricity from the Generators (Importers) on the WPM and wholesale vending to the Distributors;

Generator - a legal entity that has been issued a License for the generation of electric energy (capacity);

Transmitter - a legal entity that has been issued a License for the transmission (transportation) of electricity (capacity);

Distributor - a legal entity that has been issued a License for the distribution of electric energy (capacity);

Exporter - a legal entity that has been issued a License for the export of electric energy (capacity) from the Republic of Armenia;

Importer - a legal entity that has been issued a License for the import of electric energy (capacity) into the Republic of Armenia;

Electric Energy Transmission Network (Transmission Network) - a unified system of electric energy (capacity) facilities (transmission lines, substations and other facilities) managed and operated by the Transmitter, via which electric energy (capacity) is transmitted from Generators or Importers to Distributors and/or Consumers (Customers) and/or is wheeled to a third country;

Electric Energy Distribution Network (Distribution Network) - a unified system of electric energy (capacity) facilities (distribution lines, substations and other facilities) managed and operated by the Distributor, via which electric energy (capacity) is transmitted from Generators and/or Transmitters to Consumers;

Electricity Purchase and Sale Contract (Contract) – an agreement signed between the Licensed entities, providing for the terms of purchase and sale of electric energy (capacity);

Settlement Period – the settlement month specified in the Contract;

Export Point – the point of metering of the exported electricity specified in the Electricity (Capacity) Export Contract;

Import Point – the point of metering of the imported electricity between the Wholesale Buyer/Vendor and the Importer, specified in the Contract;

Metering Point – a set of metering devices, specified in the Contract and meeting the requirements of these Procedures, located at the Separation Point or, if the latter case is unavailable, at the closest proximity with electric connection to the Separation Point;

Separation Point – a point that specifies the balance sheet ownership border of the Licensees' energy installations;

Electric Energy (Capacity) Metering – determination of the amount of electric energy (capacity) delivered, purchased, sold, transmitted, by means of the metering devices installed at the Metering Points or, if the latter case is impossible, computed by the method of calculation;

Availability – the readiness of the Generator's energy installations to generate and deliver electricity within the limits of contractual capacity;

Contractual Capacity – active electric capacity (generation and reserve) provided by the Generator, which, according to the Contract, should be available to develop at any moment during the Settlement Period;

Inter-system Electric Transmission Line – the electric transmission line connecting the energy system of the Republic of Armenia with the energy system of a neighboring country.

2. General Provisions

2.1. According to these Procedures, the metering of electric energy (capacity) on the Wholesale Market, as well as the computation of the actual and unavoidable technological losses shall be carried out by the settlements Center.

2.2. The Settlements Center shall carry out the metering of electric energy (capacity) on the Wholesale market through the commercial automated DA System (hereafter referred to as the DA system).

2.3. According to the Service Contracts signed between the Settlements Center (SC) and the Licensees, the amounts of electric energy (capacity) metered by the SC through the DA system for the given Settlement Period and confirmed with the Licensees, shall serve a basis for the development of payment documents between the Licensees and their presentation.

2.4. The amounts if electric energy (capacity) metered by the SC for the Licensees for the given Settlement Period, regardless of the duration of the Settlement Period, shall be formed on the basis of the data acquired at 30-minute intervals from the primary units (????????? ??????) of the DA system.

2.5. The primary units of data collection through the DA system shall be the meters installed at the Metering Points.

2.6. The SC, according to the requirement of the Licensee, shall be obligated to submit corresponding information re: all the metering data referring to the Licensee.

2.7. The SC, in procedures established by the RoA Legislation and in accordance with the Service Contracts with the Licensees, shall be responsible for the reliability of information submitted by itself.

2.8. Relationships between the Licensees engaged in the purchase and sale on the Wholesale Market and the Settlements Center shall be regulated by Service Contracts between them, these Procedures and the RoA Legislation.

3. DA System and Relevant Requirements

3.1. The DA system is employed to carry out metering of electric energy (capacity) on the Wholesale Market. The metering data acquired through the DA system in conformance with these Procedures shall be used during the process of

metering of the amount of electric energy (capacity) purchased, transmitted and/or sold on the Wholesale Market.

3.2. The DA system must include:

a) A server for the collection and storage of primary system data (hereafter referred to as the System Server or SS);

b) A server for the processing and re-processing of data (hereafter referred to as the Main Server or MS);

c) Node Servers, installed at the 220 kV substations and generating plants (except for the small HPPs);

d) Regional Servers, installed at the regional centers and plant administration (except for the small HPPs);

e) Metering devices, which should consist of watt hour static ABB Euro Alpha or similar category meters with RS485 or IEC11070P interface (optical port), that meet the requirements towards static meters allowed in the RoA for commercial metering of electric energy (capacity), as well as current and voltage transformers meeting the requirements established by the WPM Technical Standards;

f) Portable computers used for the metering data input in the Metering Database in instances of the absence of communication channels and/or when the metering installations are not equipped with telecommunication equipment;

g) Telecommunication equipment comprising communication channels to corporate networks, including modems, as well as RS232-RS422/485 adapters, if necessary.

3.3. The DA System shall:

a) ensure the protection of data;

b) transfer the data electronically to the Metering Database;

c) provide a right of access for the Licensees to the metering data bases in the Regional or Node Servers of the Licensees, in order to acquire information regarding the given Licensee;

d) collate the metering data with 30-minute intervals;

e) separately register and meter the actual amounts of electric energy (capacity) in direct and reverse order;

f) register at each Metering Point, and, for the Separation Points, meter the amount of electric energy (capacity);

g) have capability for remote data transfer;

h) have at least a 35-day memory of the metering data;

i) have electric wires connecting the current and voltage transformers with the meters protected from external interference, as well as be capable of sealing all circuits and connections.

The metering equipment shall be registered in established procedures with the SC. The clocks of the DA System must be consistent with the standard Armenian time and be periodically adjusted by the SC Chief System Administrator (the responsible person assigned by the SC for the DA System).

3.4. The Metering Database shall contain:

a) Records of the electric energy (capacity) passing through the Metering Points, based on the data acquired from 30-minute intervals;

b) Information on the amendments in the records of the Metering Database, and their reasons;

c) Data on each metering device (current and voltage transformers, technical specifications of the meters, serial numbers, etc.).

3.5. The metering data shall:

a) be registered once in every 30 minutes;

b) stored in the Metering Database and be available for 13 months, further archived and stored in the SC and with the Licensees (except for the small HPPs) for 5 years.

4. Administrative Management of the DA System

4.1. The SC shall be responsible for the administrative management of the DA System through the Chief System Administrator.

4.2. The Chief System Administrator shall carry out the administrative management of the DA System through the Administrators of the Licensees (the responsible entities assigned by the Licensee for the DA System).

4.3. The Chief System Administrator shall:

- Design and provide, in an adequate form, each Licensee with the list of levelized passwords to use the DA System, for the purpose of regulation of the right of access to the DA System;

- On a periodic basis, provide the Administrators of the Licensees with latest modifications (in an electronic form) of the software used in the DA System;

- In procedures established by the SC, enter in the Main Server all information re: the restatements;

- Inform within 24 hours and submit corresponding information to the Licensees' Administrators on the amendments in the given Licensee's data and the restatements, as well as on the fact of entering such in the Main Server.

4.4. The Licensees' Administrators shall:

- Form balance settlement groups in the Regional Server, consistent with the settlement groups formed in the System Server;

- Monitor the operational condition of the metering devices (meters, current and voltage transformers, equipment for data acquisition and transfer, internal communication lines, computers) included in their service framework;

- In instances of discovering failures in the equipment specified in the item below, within 24 hours inform by telephone or fax the SC and the manager of the Licensee.

4.5. The Chief System Administrator and the Licensees' Administrators shall be responsible for maintaining the secrecy of the passwords employed in the DA System.

4.6. The Licensees' Administrators shall be obligated to archive the Metering Database in the Node and Regional Servers under their jurisdiction, no later than once in a 15-day period.

5. Collection and Periodicity of Metering Data

5.1. Collection of the metering data is carried out by the SC, through the DA System. The SC shall be responsible for the delayed and/or inaccurate data collection due to its negligence.

5.2. For the purpose of data collection,

a) The SC shall ensure:

- the operational condition of software packages for the System, Main, Node and Regional Servers;

- data collection from the Node and Regional Servers to the System Server.

b) The Licensees (except for the small HPPs) shall ensure:

- data collection from the meters included in the DA System (including the small HPPs) to the Node and Regional Servers;

- the operational condition of the devices serving for the telecommunication of Regional and Node Servers, as well as the metering data.

c) The System Operator shall submit information to the SC on the availability testing of the Generators conducted by itself during the Settlement Period, as well as on the excess or insufficient development of contractual capacities.

5.3. The metering data shall be fixed as of 24:00 hours of the middle and the last day of the Settlement Period, and collected during the 3 calendar days following those days.

5.4. Within 5 calendar days, on the middle and the last day of the Settlement Period, the SC shall develop the actual electric energy balance of the Power system, according to all Separation and Metering Points.

5.5. For the development of the electric energy balance, the basis shall be the settlement groups, agreed upon between the SC and the Licensee, which should be replicated unchanged in the System and Regional Servers. Any changes in settlement groups shall be carried out only by mutual agreement between the parties.

5.6. Within the time period specified in the Contract and in established procedures, the SC shall draft the Acts of electricity delivery (acceptance) subject to signing between the Licensees, and forward to the Licensees for signing.

5.7. For the purpose of calculation of unavoidable technological and actual losses at the WPM, as well as to inspect the operation of the meters located at the Metering Points, the SC shall have the right to form any computation groups from the meters included in the DA System.

5.8. In the event that the Licensee has any doubts with regards to the accuracy of the Metering data referring to itself, the Licensee shall have the right of access to the other party's premises to take meter readings from the contractually established Metering Points, with the help of portable computers.

6. Metering of the Electric Energy (Capacity) Delivered by the Generator

6.1. The metering of the electric energy (capacity) delivered by the Generator shall be carried out at the Separation Points of the Generator-Transmitter and/or the Generator-Distributor.

6.1.1. If the Separation Points of the Generator-Transmitter and/or the Generator-Distributor are equipped with metering devices meeting the required conditions, then the SC shall be obligated to meter:

a) the amount of electric energy (capacity) delivered to the Wholesale Buyer/Vendor by the Generator, by means of the metering devices installed at the Separation Points of the Generator-Transmitter and/or the Generator-Distributor;

b) the amount of electric energy (capacity) delivered to the Generator by the Distributor, by means of the metering devices installed at the Separation Points of the Generator-Distributor;

c) the amount of electric energy (capacity) delivered to the consumers feeding from the electric network under the balance sheet ownership of the Generator, by means of the metering devices installed at the Separation Points of the Generator-Customer.

6.1.2. If the Separation Points of the Generator-Transmitter and/or the Generator-Distributor are not equipped with metering devices meeting the required conditions, then the SC shall be obligated to meter:

a) the amount of electric energy (capacity) generated directly on the generator unit clamps without thyristor excitation, by means of the metering devices installed at the generator unit clamps;

b) the aggregate amount of electricity consumed by the Generator for ancillary and economic needs, by means of the metering devices installed at the ancillary need transformers and the ancillary need lines;

c) the amount of electric energy (capacity) delivered to the consumers feeding from the electric network under the balance sheet ownership of the Generator, by means of the metering devices installed at the Separation Points of the Generator-Customer;

d) the amount of losses of electricity computed by actual modes of power transformers.

6.2. The SC shall carry out the metering of the amount of electric energy (capacity) with the Generator according to the methods described in 6.1.2 only in cases, when the DA System does not allow for the metering methods described in 6.1.1.

6.3. For the given Settlement Period, in case of using methods described in 6.1.1, the amount of electric energy delivered to the Wholesale Buyer/Vendor shall be determined by means of the metering devices installed at the corresponding Separation Points described in 6.1.1.

6.4. For the given Settlement Period, in case of using methods described in 6.1.2, the amount of electric energy delivered to the Wholesale Buyer/Vendor by the Generator (W_{WBV}) shall be determined in the following manner:

$$W_{WBV} = W_G - W_{AN} - \Delta W_{ANtr} - \Delta W_{PT}$$

where:

W_G - is the amount of electric energy (capacity) delivered from the generator clamps of the Generator, determined by means of the metering devices specified in item 6.1.2(a);

W_{AN} - is the aggregate amount of electric energy used for the Generator's ancillary and economic needs, which is determined by means of the metering devices specified in item 6.1.2(b) and which does not include:

- the amount of electricity delivered to the Generator from the 35kV and below network of the Distributor;
- the amount of electricity consumed by the customers feeding from the Generator's ancillary needs;

ΔW_{ANtr} - is the amount of electricity losses computed by the actual modes in the Generator's ancillary need transformers. It is available in the formula if the metering devices are installed at the low voltage side of the ancillary need transformers. Otherwise, the value of ΔW_{ANtr} is considered equal to 0;

ΔW_{PT} - is the amount of electricity losses computed by the actual modes in the Generator's power transformers;

6.5. For the given Settlement Period, in case of the circuitries described in items 6.1.1 and 6.1.2, the amount of electric energy delivered to the Exporter by the Generator (W_{Ex}) is determined in the following manner:

$$W_{EX} = W_{TR}\left(1 + \frac{a_{TR}}{100}\right)$$

where:

W_{TR} - is the amount of electric energy delivered to the Exporter by the Transmitter at corresponding Export Points;

α_{TR} - is the amount of actual losses from the Generator's separation Point to the Export Point.

4.5. For the given Settlement Period, in case of the methods described in items 6.1.1, the amount of electric energy delivered to the Generator by the Distributor (W_{DG}) is determined in the following manner:

$$W_{DG} = W_D - W_{CUS}$$

where:

W_{DG} - is the amount of electric energy delivered to the Generator by the Distributor, determined by means of the metering devices installed at corresponding Separation Points;

W_{CUS} - is the amount of electricity delivered to the customers feeding from the electric network under the balance sheet ownership of the Generator, determined by means of the metering devices installed at corresponding Separation Points.

6.6. For the given Settlement Period, in case of the methods described in items 6.1.2, the amount of electric energy delivered to the Generator by the Distributor (W) is determined in the following manner:

$$W = W_{AN} + \Delta W_{PT} + \Delta W_{ANT}$$

where:

W_{AN} - is the aggregate amount of electric energy used for the Generator's ancillary and economic needs, which does not include:

- the amount of electricity delivered to the Generator from the 35kV and below network of the Distributor;
- the amount of electricity consumed by the customers feeding from the Generator's ancillary needs;

ΔW_{PT} - is the amount of electricity losses computed by the actual modes in the Generator's power transformers;

ΔW_{ANT} - is the amount of electricity losses computed by the actual modes in the Generator's ancillary need transformers. It is available in the formula if the metering devices are installed at the low voltage side of the ancillary need transformers. Otherwise, the value of ΔW_{ANT} is considered equal to 0;

6.7. For the given Settlement Period, the Generator's capacity available to generate electric energy and subject to payment by the Wholesale Buyer/Vendor, shall be determined in the manner established by the Contract, in conformance with the Electric Capacity Assessment Procedures.

7. Metering of the Amount of Electric Energy (Capacity) Transmitted by the Transmitter

7.1. The metering of the amount of electric energy (capacity) transmitted by the Transmitter shall be carried out at the Metering Points of the Generator-

Transmitter and the Transmitter-Distributor, as well as at the Metering Points of Import and Export.

7.2. In order to determine the amount of electric energy (capacity) transmitted by the Transmitter, the SC shall be required to meter:

a) The amounts of electric energy (capacity) delivered to the Wholesale Buyer/Vendor by the Generator, according to the formulas and principles presented in 6.3 and/or 6.4;

b) The amounts of electric energy (capacity) delivered to the Wholesale Buyer/Vendor by the Importer, at the Import Points established between the Importer and the Wholesale Buyer/Vendor;

c) The amounts of electric energy (capacity) delivered for the Exporter by the Transmitter, at the Export Points established between the Exporter and the Transmitter.

7.3. For the given Settlement Period, the aggregate amount of electric energy (capacity) metered in accordance with item 7.2 herein, shall be considered the amount of electric energy (capacity) transmitted by the Transmitter.

8. Metering of Electricity Delivered to the Distributor

8.1. The metering of the electric energy (capacity) delivered to the Distributor is carried out at the Separation Points of Transmitter-Distributor and the Generator-Distributor.

8.2. The SC shall be obligated to meter with the Distributor:

a) The amounts of electric energy delivered by the Wholesale Buyer/Vendor to the Distributor, at the Separation Points of the Generator-Distributor and/or the Transmitter-Distributor;

b) The amounts of electric energy delivered to the Generator by the Distributor, at the Separation Points of the Generator-Distributor;

c) The amounts of electric energy (capacity) wheeled for the Exporter by the Distributor, at the Export Points established between the Distributor and the Generator.

8.3. If the Separation Points of the Transmitter-Distributor and/or the Generator-Distributor are equipped with metering devices meeting the required conditions, then for the given Settlement Period the amount of electric energy delivered to the Distributor by the Wholesale Buyer/Vendor shall be determined by the meters installed at corresponding Separation Points.

8.4. If the Separation Points of the Generator-Distributor are not equipped with metering devices meeting the required conditions, then for the given Settlement Period the amount of the electric energy delivered to the Distributor by the Wholesale Buyer/Vendor shall be considered equal to the amount of electric energy delivered to the Wholesale Buyer/Vendor by the Generator, at the Separation Points of the Generator-Distributor.

8.5. If the Separation Points of the Transmitter-Distributor are not equipped with metering devices meeting the required conditions, then for the given Settlement Period the amount of the electric energy delivered to the Distributor by the Wholesale Buyer/Vendor shall be determined in the following manner:

a) If the Metering Points are the metering devices installed at the 110 kV inputs of the Transmitter's 220 kV substation auto-transformers, then the amount of the electric energy delivered to the Distributor by the Wholesale Buyer/Vendor shall be considered the amount of electric energy metered by the aforementioned metering devices, neglecting the losses at the 110 kV busbars;

b) If the Metering Points are the metering devices installed at the 6/10/35 kV outputs of the Distributor's 110 kV substations, then the amount of the electric energy delivered to the Distributor by the Wholesale Buyer/Vendor (W_D) shall be determined in the following manner:

$$W_D = W_{TRD} + \Delta W_{PT} + \Delta W_L$$

where:

W_{TRD} - is the amount of electric energy delivered to the Distributor by the Wholesale Buyer/Vendor, at the Metering Points established between the Transmitter and the Distributor;

ΔW_{PT} - is the amount of electricity losses computed by the actual modes in the power transformers under the balance sheet ownership of the Distributor;

ΔW_L - is the amount of the actual electricity losses computed by the actual modes, at the HV lines laid in-between the Separation Points of the Transmitter-Distributor and the Metering Points.

8.6. For the given Settlement Period, the amount of electric energy delivered to the Generator by the Distributor shall be determined according to the formulas presented in items 6.6 or 6.7, depending on the methods presented.

8.7. For the given Settlement Period, the amount of electric energy wheeled by the Distributor for the Exporter shall be considered the amount of electric energy metered at corresponding Export Points.

9. Metering Inter-System Flows of Electric Energy and Capacity

9.1. Inter-system flow is the flow of electric energy through inter-system electric transmission lines.

9.2. The SC shall meter the amounts of electric energy received and/or delivered through inter-system flows within the amount of electric energy (capacity) received and/or delivered by the Wholesale Buyer/Vendor.

9.3. The electricity losses incurred at the inter-system transmission lines shall be proportionally accounted for in the costs of the owners of such lines, unless otherwise stated in the contract signed between the parties.

10. Special Cases of Electric Energy and Capacity Metering

10.1. In order to verify the accuracy of the metering data, within 10 days following the expiration of the Settlement Period, the SC shall be obligated to develop the balance of electric energy purchased, transmitted and/or sold on the Wholesale Market, by separate nodes and node groups of the power system, and compare the results with the permissible limits of imbalance.

10.2. If the developed balance in the system section demonstrates an excess of the permissible limits of imbalance, then the SC shall be obligated to:

a) Draft an Act, with participation of the contractual parties, on the fact of metering violation and its reasons;

b) Perform a recalculation, employing the methodologies agreed upon between the SC and the ERC;

c) Coordinate with the Licensees the results of the recalculations in advance, so that they can be taken into account in the amounts of the electric energy purchased, transmitted and/or sold during the next Settlement Period.

10.3. The permissible limit of imbalance is determined by means of the methodologies agreed upon between the SC and the ERC.

10.4. In instances of exceeding the permissible limits of imbalance, the parties to the contract shall take appropriate measures towards the restoration of the balance.

11. Calculation of Losses in the Transmission Network

11.1. Before the 25^{th} day of the next month, the SC, in accordance with the methodologies approved by the ERC, shall compute the amount of unavoidable technological losses in the Transmission network.

11.2. Before the 8th day of each month, the SC shall be obligated to submit information in writing to the Wholesale Buyer/Vendor and the Transmitter about the amounts of actual losses in the Transmission network computed during the previous month.

12. Settlement of Disputes

12.1. The disputes between the SC and the Licensees shall be settled in procedures established by the Contracts between them.

13. Transitional Provisions

13.1. Until the re-signing of contracts pursuant to these Procedures, the Metering Points defined in Article 1 of these Procedures shall be the Delivery, Transfer and/or Control metering points stated in the effective Contracts.